

REMARKS

Claim 1 has been amended by altering the word order and reiterating that the polymer in line 8 is a propylene polymer .

Claims 2-5, 7-9 and 12-14 are have been amended to correct the reference to the molded article of claim 1.

Claims 3, 4 and 9 have been amended by replacing "a" with "the" in two places.

Claim 4 has been amended to correct typographical errors.

Claim 10 has been amended by replacing "is" with "concentration" and by altering the word order. It has also been amended to reiterate that a modified catalyst is produced.

Claim 15 has been amended to replace "2 parts to 5 parts by weight" with "2 wt% to 5 wt%" which is used in the preceding claims.

No new matter has been added.

Claim Objections

The Examiner has objected to claims 2-5, 7-9, 12 and 14 because the reference to the molded article of claim 1 was missing. Applicants have corrected the preamble to these claims, thereby overcoming the objection.

The Examiner has objected to claim 3 for the use of the term "a" instead of "the." Applicants have corrected the term, thereby overcoming the objection.

The Examiner has objected to claim 5 and claim 9 for typographical errors. Applicants have corrected the errors, thereby overcoming the objection.

The Examiner has objected to claim 15, indicating that it is not clear whether the recitation of "2 parts to 5 parts by weight" further limit claim 10 which recites a range of "2 wt% to 5 wt%." Applicants have replaced "2 parts to 5 parts by weight" with "2 wt% to 5 wt%" to maintain consistency, but note that claim 15 further limits the pigments used. As such, Applicants submit that the objection has been overcome.

Rejections Under 35 USC §112, second paragraph

The Examiner has rejected claims 1-5, 7-9 and 12-14 for lack of antecedent basis for the term "polymer nucleated with a polymerized vinyl compound" in claim 1.

Applicants have amended claim 1 to reiterate in line 8 that the polymer nucleated with a polymerized vinyl compound is a propylene polymer. Thus, Applicants have overcome the rejection.

The Examiner has rejected claims 10, 11 and 15 as lacking antecedent basis for the term "modified catalyst" in claim 10.

Applicants have amended claim 10 to reiterate in line 3 that a modified catalyst is produced.

The Examiner has rejected claims 1-5 and 7-15 for the recitation of delta max, contending that delta max measurements do not appear to be universal but specific only to the three pigments shown in the Specification. Applicants respectfully traverse.

Applicants submit that the colors in Table 1 of the application cover the whole range of spectrum of visible light (white – red – blue) emitted by the pigments. Moreover, the pigments for the different colors that define the visible spectrum represent the highest shrinkage within pigments for each color. This provides a “shrinkage range” for conventionally used pigments. As a result, other conventional pigments within this visible spectrum would give comparable or even lower shrinkage than the pigments tested. Consequently, the Delta Max is clearly defined to one skilled in the art and can be generalized for any pigment in that the pigment’s Delta Max will fall within the range defined in the application.

Applicants also note that there is a typographical error in Table 1 that incorrectly lists the cross direction Delta Max value for talc-nucleated homo PP as 0.41. Delta Max is the difference in shrinkage values between “natural” talc-nucleated PP and pigmented talc-nucleated PP, so this value should be 0.42.

Rejections Under 35 U.S.C. § 103

The Examiner has rejected claims 10 and 11 as obvious over US Patent No. 4,551,501 to Shiga et al. alone or in view of US Patent US Patent No. 4,670,491 to Stretanski et al and/or US Patent No: 4,192,794 to Wang et al. The Examiner contends that Shiga et al. disclose a molded article made from a polymer composition comprising a blend of crystalline polypropylene and vinyl cycloalkanes. He contends that treatment of a Ti/Et₃Al catalyst with vinyl cyclohexane results in the formation of poly(vinyl cyclohexane) containing the active catalyst. He further contends that in the subsequent step propylene is

polymerized in the presence of the catalyst modified with a polymer containing vinyl units previously prepared. Lastly, he contends that the inventors contemplated the use of additives normally incorporated into polypropylene, such as pigments, however no specific amount of pigment is disclosed. He then concludes that the skilled artisan would have found it obvious to arrive at the range of colorant because this would be optimization.

The Examiner also points to the disclosure of Stretanski, which teaches polypropylene compositions containing 2.5 wt % titanium oxide, and Wang, which teaches polypropylene resin pigmented with 5 wt % titanium oxide. The Examiner concludes that one with ordinary skill in the art would have been motivated to use the same amount of coloring agent taught in these references when using the Shiga et al. invention in order to produce a colored polypropylene composition.

The Examiner acknowledges that Shiga et al. is silent with respect to the particular properties recited in the present claims, but that a reasonable basis exists to believe that the prior art compositions would exhibit the same properties since, in his opinion, they recite essentially the same composition.

Applicants respectfully traverse.

Applicants point out that the claims were previously amended to indicate that an organic non-white or organic non-black pigment is used. Shiga et al. do not discuss organic non-black or non-white pigments. Both Stretanski et al. and Wang et al. are concerned with non-organic pigments. Neither Stretanski et al. or Wang et al. suggest that similar amounts of organic non-black or non-white pigments can be used.

In addition, Applicants present the results of comparative tests in support of the invention. Table 1a below shows the shrinkage effect of un-pigmented PP which is nucleated with a master-batch (1) in a similar way as disclosed and exemplified in Shiga et al. and (2) which is nucleated according to the present invention (i.e. in-situ during polymerization using the modified catalyst). While there is no significant difference in shrinkage between the tested materials in the flow direction, a marked difference in shrinkage is present in the cross direction. Here, the test shows that when a non-nucleated PP material is nucleated even with a small amount of master-batch, a clear increase in shrinkage is seen (compare Reference Ex. 1 with Comparative Ex. 2). This increase, however, is not proportional to the shrinkage behavior, which increases to a much lesser extent with increasing master-batch amounts (compare Comparative Ex. 2 with Comparative Ex. 3). It is notable that the mechanical blending used by Shiga et al. limits the amount of master-batch (which is not described as a base resin) that can be added to 50 wt%, due to homogeneity and phase change.

This leads to the conclusion that a higher level of shrinkage results from the nucleated homo PP of the invention, denoted in Table 1a as "Ex. 4 of the invention" and equating to "homopolymer of Example 2" described in the application. One can therefore state that the in-situ nucleation used in the present invention has a greater effect on shrinkage than does the master-batch nucleation used by Shiga et al. As a consequence, the present invention surprisingly more effectively overcomes the influence of pigments on shrinkage than does the master-batch nucleation used by Shiga et al.

Table 1a

Shrinkage test was carried out in each test by molding a box in same conditions and using same amount of material.	Shrinkage, %	Flow direction	Cross direction
Reference Ex. 1	Non-nucleated homo PP	1.58	1.51
Comparative Ex. 2	Non-nucleated homo PP +2% master-batch of nucleated homo PP	1.59	1.61
Comparative Ex. 3	Non-nucleated homo PP +5% master-batch of nucleated homo PP	1.59	1.68
Ex. 4 of Invention	Nucleated homo PP of the invention	1.60	1.71

As further support of the difference between the master-batch nucleated PP material of Shiga et al., as represented by PP material nucleated using master-batch

blending, and the "in-situ" nucleated PP of the present invention, the difference in crystallization temperature (Tcr) between these materials was explored.

Applicants first note that Shiga et al. do not provide the PP properties of the base PP and the nucleated master-batch, nor the Tcr of the master-batch (1). It seems however that the Tcr of the nucleated master-batch (1) of Example 1 of Shiga et al. is clearly more than 127°C. Consequently, in order to perform a valid comparison, the side-by-side experiment conducted and reported in Table 2a used the nucleated homo PP of Example 2 from the application as the nucleated master-batch PP material for the comparative examples, Ex. 5-7. Applicants also note that the Tcr of the nucleated homo PP of Example 2 from the application (referred to as Ex. 8 in Table 2a) represents the lower limit possible for PP as nucleated in Example 1 of Shiga and can be higher depending on the other properties of the PP such as the density and/or isotacticity. These results are presented in Table 2a.

Table 2a

		Reference Ex. 4	Comparative Ex. 5	Comparative Ex. 6	Comparative Ex. 7	Ex. 8 of Invention
		Non- nucleated homo PP	Non- nucleated homo PP + 1% masterbatch of nucleated homo PP	Non- nucleated homo PP + 2% masterbatch of nucleated homo PP	Non- nucleated homo PP + 5% masterbatch of nucleated homo PP	nucleated homo PP
Tcr of PP	°C	111,7	121,2	122,1	123,1	126,8
Tm of PP	°C	163,6	165,5	164,6	164,1	
dH of PP	J/g	77	82,5	81,2	81,8	
dH of PE	J/g	117	117	117	117	
Tensile Modulus, 7d	MPa	1130	1250	1290	1350	
Charpy impact, RT	kJ/m ²	62	72,6	73	83,9	
Charpy impact, 0°C	kJ/m ²	15,7	12,2	15,6	19,2	
Charpy impact, - 20° C	kJ/m ²	7,6	8,6	8,7	9,7	

Here, it is apparent that the 126.8°C Tcr of the nucleated homo PP of Ex. 8 of the invention, equating to "homopolymer of Example 2" described in the application, is markedly higher compared to master-batch nucleated comparative examples Ex. 5, 6 and 7 (121.2°C, 122.1°C and 123.1°C, respectively).

Similar to the shrinkage experiments summarized in Table 1a, an addition of a nucleating agent into a non-nucleated PP of reference Ex.4, even in small amounts, causes significant increases in Tcr. And like the shrinkage results, the Tcr increase is not proportional to the increase in the amount of master-batch added, but only gradually reaches a certain Tcr level which depends on the Tcr of the base PP used and the master-batch of nucleated homo PP. In this experiment the nucleated master-batch has a Tcr equivalent to the Tcr of the nucleated homo PP of the present invention. This allows us to conclude that the nucleated homo PP of the invention is always higher than the Tcr of the blends made using the masterbatch of nucleated homo PP.

It is well known that the higher the Tcr, the faster the crystallization. Thus, the conclusion drawn from the results summarized in Table 2a is that the nucleated PP of the invention crystallized quicker than the PP nucleated with the master-batch.

According to the present invention, fast crystallization can be used for controlling the nucleation effect of different pigments and thus the nucleation of the overall molding process, which makes changes of pigments more feasible. While it was also known that pigments also increase the Tcr of a PP material, the data presented on page 17 of the present application shows that the increase is typically lower than that achievable with the nucleated PP of the invention. Here, the Tcr of the non-nucleated PP changes from

115.8°C to 115.7°C for white pigment, 119.5°C for red pigment and 129.3°C for blue pigment. Yet the nucleated PP of the homopolymer of Example 2 described in the application (i.e. Ex. 8 in Table 2a) has a Tcr of 126.8°C.

Thus, the nucleated PP of the invention has a higher nucleation density and its nucleation effect is higher than that of the pigments, which allows it to "override" or control the effect of pigment on crystallization (and thereby the pigment nucleation effect). Also in the case of blue pigmented PP with a high Tcr, the controlling effect of the nucleated PP homopolymer of Example 2 described in the application was much pronounced compared to the talc-nucleation or no nucleation examples.

To summarize, in view of the information presented in Table 2a and the application itself, **the surprising conclusion must be that due to the higher Tcr, the nucleated PP of the invention has a better controlling effect on pigment crystallization than does PP material nucleated with a master-batch.**

In view of the above, Applicants respectfully request reconsideration and removal of the rejections.

The Examiner has rejected claim s 1-5 and 7-15 as obvious over Shiga et al. in view of JP 2-41343. The Examiner refers to the discussion of Shiga (see above) and notes that JP 2-41343 relates to pigmented propylene compositions, showing that organic pigments such as cyanine blue and quinacridone red are used in an amount of 1-5 wt%. The Examiner

concludes that one of ordinary skill in the art would combine Shiga and JP 2-41343 to "provide the desired color to the resin." Applicants respectfully traverse.

Applicants have provided comparative test results showing the surprisingly improved results of the present invention compared to Shiga's method and product. Thus, Applicants respectfully request reconsideration and removal of the rejection.

In view of the above remarks, all of the claims remaining in the case are submitted as defining non-obvious, patentable subject matter.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Susan Gorman (Reg. No. 47,604) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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